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CLIFFWOOD BEACH FOSSIL PRESERVE ENVIRONMENTAL ASSESSMENT

March 1982

New Jersey Department of Environmental Protection
Division of Coastal Resources
CN 401
Trenton, New Jersey 08625

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SUMMARY

1. The Fossil Preserve built as part of the Cliffwood Beach Shore Protection project in the mid 1970's is important to scientists.
2. The Township of Aberdeen now wants the Preserve filled to halt further cliff erosion and avoid safety problems.
3. Before filling the Preserve, the N.J. Department of Environmental Protection, Division of Coastal Resources will mitigate the loss of access to the fossils by contracting with Rutgers to conduct a new scientific study of the fossil exposure to retrieve and analyze a fresh supply of fossils.

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I. PROPOSED ACTION: PURPOSES, BACKGROUND, AND NEED

For more than 50 years, Federal, State and local governmental agencies have attempted to protect the bluff area of Aberdeen Township, Monmouth County, New Jersey along the Raritan Bay, known as Cliffwood Beach, from the natural processes of erosion and accretion.

In the mid 1970's, the New Jersey Department of Environmental Protection (hereafter the State) built a 3,389 feet long stone seawall at the base of the cliff, to protect the shore from further erosion from wave and storm action from Raritan Bay. At the request of Aberdeen Township (then called Matawan Township, hereafter the Township), the seawall phase of this shore protection project included the preservation of a 100 feet by 125 feet area of the cliff exposure known to the scientific community of the state, nation and world as a superior location for collecting and analyzing fossils of the paleoenvironment of 100 million years ago. The Fossil Preserve is protected by 210 linear feet of creosoted timber bulkheading and 100 feet of steel bulkhead. Wooden steps were built as part of the project to provide access down into the Preserve. Figure 1 gives the location of the Fossil Preserve. Figures 2,3, and 4 reproduce photographs of the Preserve in 1979 and 1981.

The second and last phase of the shore protection project for Cliffwood Beach involves placing 32,000 cubic yards of beachfill along the bayfront in front of the existing seawall, and approximately 65,000 cubic yards of beachfill for the construction of sand dunes to the northwest of the site along with the replanting of marsh grasses. In addition, beginning with the completion of Phase One of the project, the Township began to request that the State take action to "save" the house on the top of the cliff above the Fossil Preserve, as erosion and slumping of the cliff continued to take place.

This environmental assessment will identify four main alternatives under consideration for the proposed action, which is to stabilize the Cliffwood Beach fossil exposure preserved at local request as part of the State Shore Protection Project's first phase completed in 1975. The assessment will retrace the history of the Cliffwood Beach Shore Protection Project, analyzing the processes of shoreline erosion and accretion, as well as the processes of erosion and slumping that have taken place since the Fossil Preserve was created in 1975. This assessment will also review the scientific value of the Fossil Preserve. The environmental consequences of each of the alternatives will be defined. The assessment will summarize the consultation with individuals and local environmental commissions, governmental agencies, scientific agencies, and the academic community that have taken place over the fate of the Fossil Preserve in recent years. Finally, this environmental assesement will conclude with a recommendation and decision on the selected alternative to stabilize the cliff at the Fossil Preserve.

FIGURE 1

Fossil Preserve Site Plan and Location Map

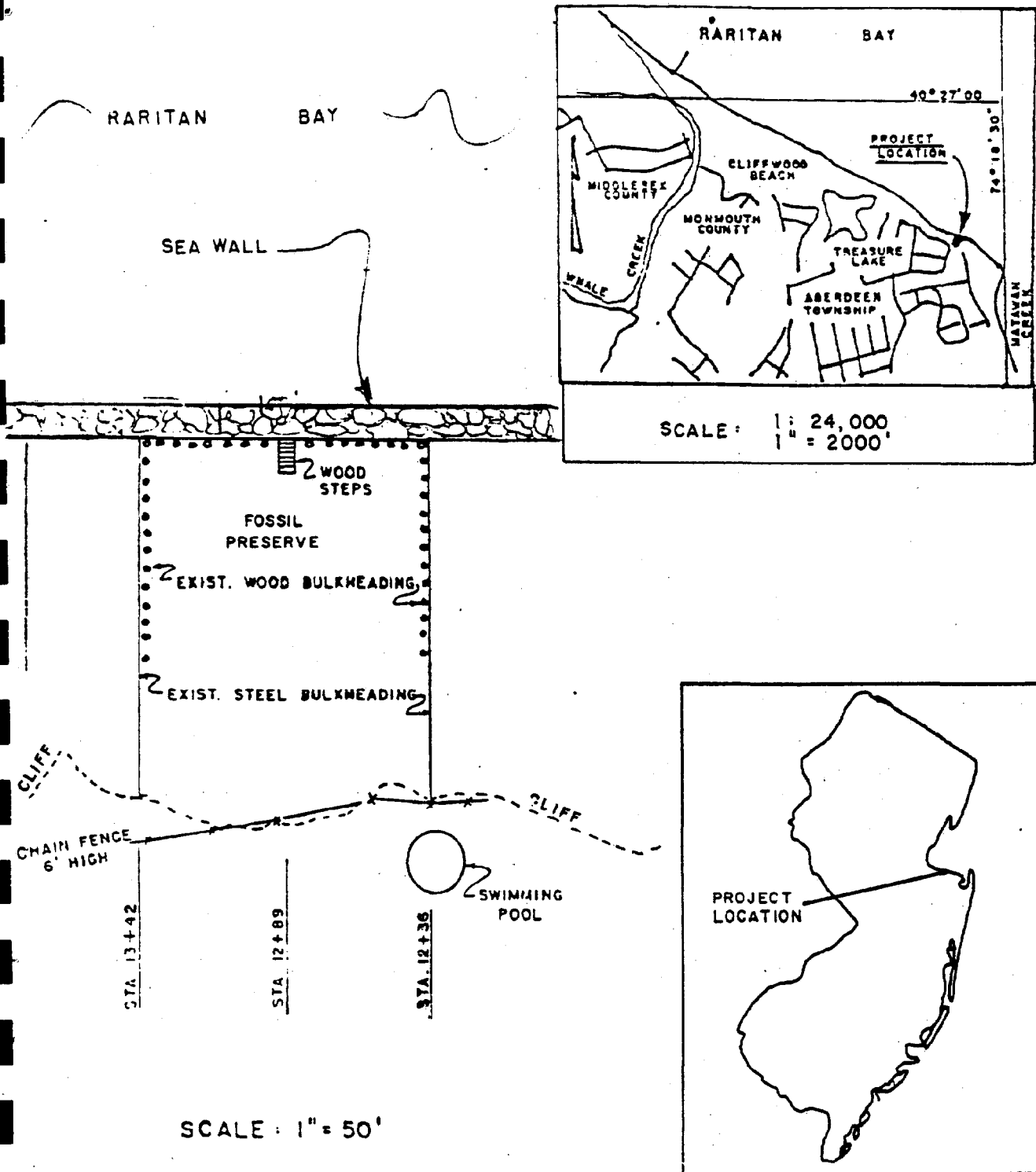


FIGURE 2

PHOTOGRAPH OF THE PRESERVE FROM THE
CLIFF TOP, 1979



FIGURE 3

PHOTOGRAPH OF THE PRESERVE FROM THE SEAWALL,
SHOWING ACCUMULATED ERODED AND SLUMPED
SEDIMENT, 1979

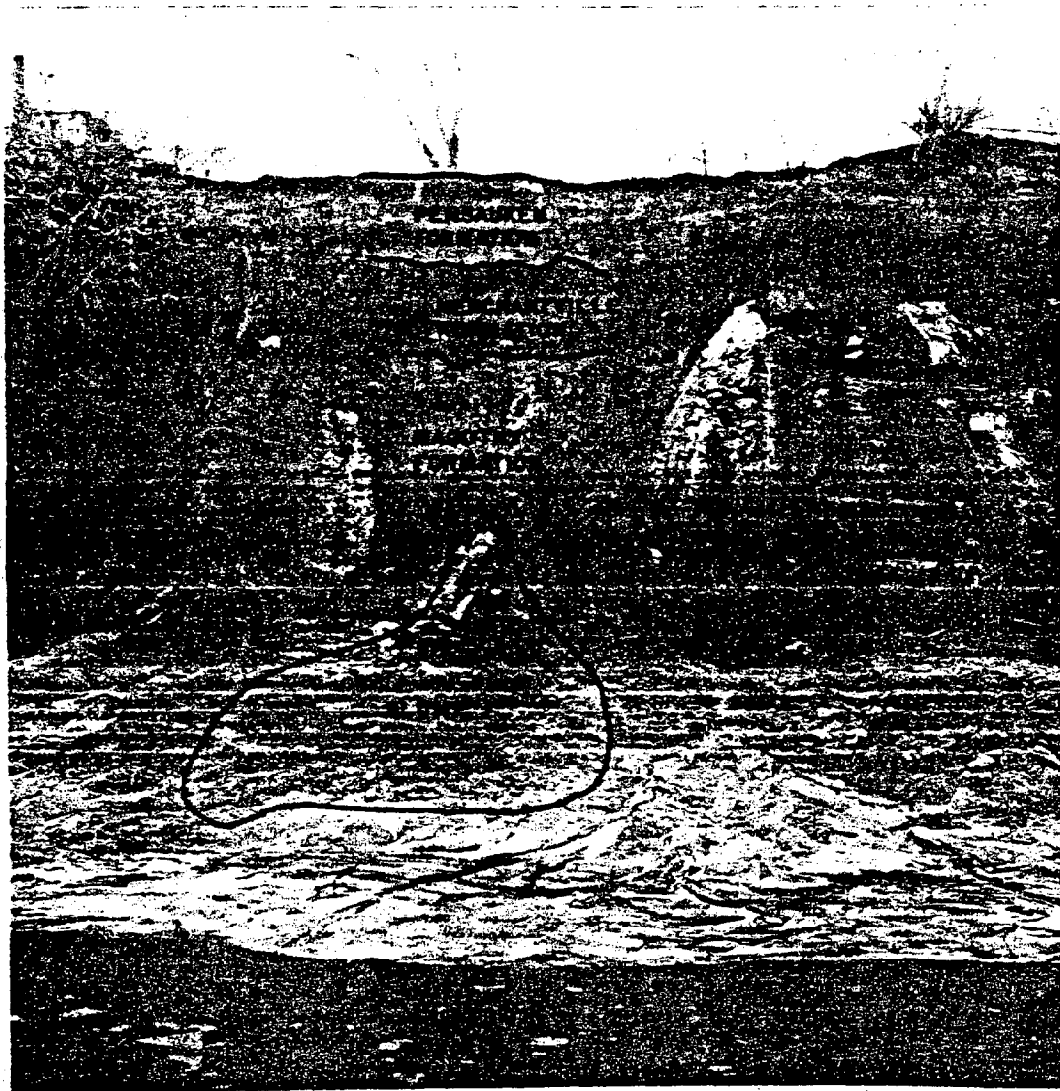


FIGURE 4

AERIAL PHOTOGRAPHS OF THE CLIFFWOOD BEACH
SHORE PROTECTION PROJECT, 1981



II. ALTERNATIVES

Now that the Township, the local government that originally requested the Cliffwood Beach Shore Protection Project and shared in its financial costs, has requested formally that the Fossil Exposure, preserved at its request in the mid 1970's, be filled, the State has an obligation to explore the several alternatives for the fate of the Fossil Preserve. There are four principal alternatives: (1) Fill, (2) Salvage then Fill, (3) Stabilize, and (4) Public Purchase of the Cliff Top.

A. FILL ALTERNATIVE

The simplest alternative to meeting the objective of halting further erosion of the cliff and slumping, that has led to a retreat of the cliff, would be to fill the wooden and steel bulkhead "box" created in the mid 1970's as the Fossil Preserve. The fill would create an artificial slope that would cover the now exposed cliff that is retained by the wooden box.

To analyze the situation and recommend an engineering solution for filling the exposure, Raamot Associates of Parlin, New Jersey, was retained by the State in 1979. The Raamot Associates report concluded that the deterioration of the bluff was caused by processes of surface erosion and small slump type failures. Raamot Associates conducted 20 shallow borings at the base of the bluff and found a hard bottom at approximately four feet above mean sea level, under the soupy sediment which accumulated behind the box bulkhead. The hard bottom is most likely the layer of three quarter inch broken stone placed at the time the seawall and bulkhead were built, in the mid 1970's. While this paving may have been intended to give firm footing to those coming to collect fossils, the construction of the box behind the sea wall retained the eroded material from the bluff face to its present accumulation of six feet. Construction of the sea wall blocked the cliff base from the cleansing wave action of Raritan Bay.

Raamot Associates prepared a plan on how to fill the Fossil Preserve with specifications for various types of fill material necessary to complete this alternative, from both engineering and soils perspectives. The estimated cost for the fill alternative in 1981 dollars is \$165,000. Because the seawall was not built anticipating its use by construction equipment, the Preserve cannot easily be filled until the beach fill phase of the Cliffwood Beach Shore Protection Project is well under construction. A temporary ramp must be built from the beachfill up over the sea wall to provide access to the Preserve for construction equipment.

B. SALVAGE THEN FILL ALTERNATIVE

A second alternative to the fate of the Preserve would be to fill the Preserve, as in the first alternative, but only after mitigating the near complete reduction in access to the site for scientific purposes that will result. While filling the Preserve will not destroy the fossil exposure in the cliff face, the fossils

will be rendered inaccessible until someone goes to the great expense of removing the fill. It must also be noted that the Fossil Preserve in its current state has been rendered relatively inaccessible due to the slumping of cliff material that has buried the most productive fossiliferous strata of the exposure, lying at the base of the cliff. By excluding the flow of the tide and storms from Raritan Bay, the sea wall and timber bulkhead box have stopped the constant regeneration of the bluff face and the production of fresh fossiliferous material.

The Salvage alternative involves first improving the short term accessibility of the fossiliferous strata of the cliff face through removal of the soupy sediment. Then, an appropriate scientific team would be allowed sufficient time to collect new fossils, and record scientifically, through photographs, sketches and by other means, the location and condition of the exposure. Following the removal of a fresh supply of geological and paleontological samples, the Fossil Preserve would be filled as in the first alternative, although a protective sheeting of heavy plastic or some appropriate material should be placed over the cliff face prior to the placement of fill material. The estimated cost for this alternative is \$165,000 plus \$10,000 for salvage work.

C. STABILIZE ALTERNATIVE

A third alternative involves engineering and land acquisition steps necessary to stabilize the Fossil Preserve, protecting the exposure's accessibility for future scientific investigations, while addressing the fate of the house on the top of the cliff.

From an engineering perspective, Figure 5 shows one proposal that would leave the timber bulkhead in place intact and build a series of concrete or steel support joists along the full 100 foot span of the Fossil Preserve. Pre-stressed interlocking concrete slabs would then be placed on top of the support joists, creating a roof above the Fossil Preserve. The exposed face of the bluff could then be backfilled using the three layer system proposed by Raamot Associates. Several alternatives to this concept would leave the face of the cliff stabilized and the base of the cliff open for access to the fossiliferous strata. The base of the Fossil Preserve would first need to be excavated prior to construction of any of all these alternatives. A cost estimate for the construction portion of this alternative is \$250,000.

Another related engineering alternative would relieve a portion of the groundwater pressure, which currently contributes to the erosion of the face of the bluff in the Fossil Preserve. As a first step, water and mud at the base of the cliff would be pumped out of the box. Then cuts would be made in the backfilled bluff at different elevations. The cliff would then be reconstructed with gabions, so groundwater would be collected and diverted into the gabions, rather than seeking the open Fossil Preserve which now serves as a sink for this sheet flow stormwater. See Figure 6 for a sketch of this alternative. The estimated cost of this alternative is \$265,000 in addition to beachfill costs.

FIGURE 5

STABILIZE ALTERNATIVE I

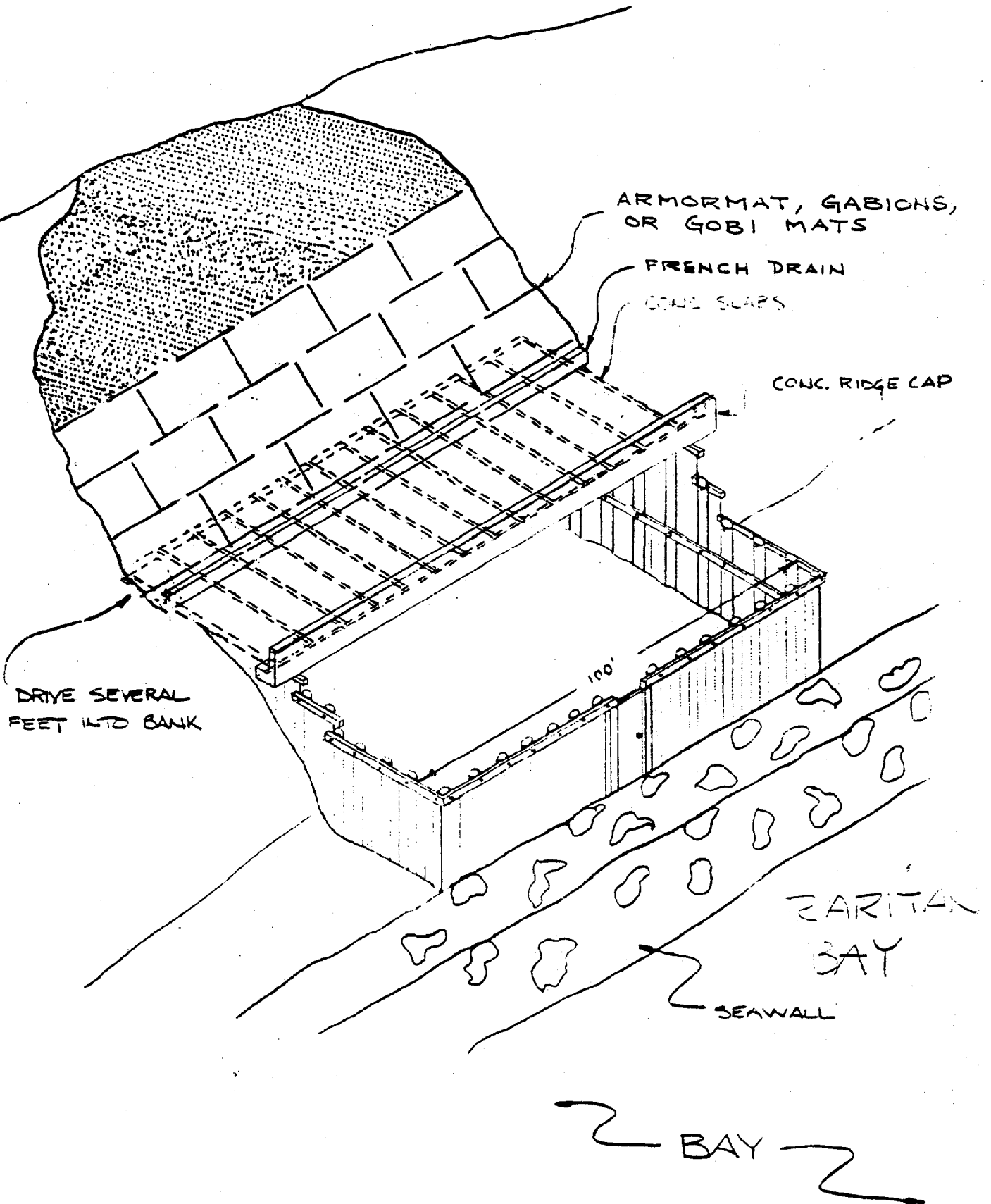
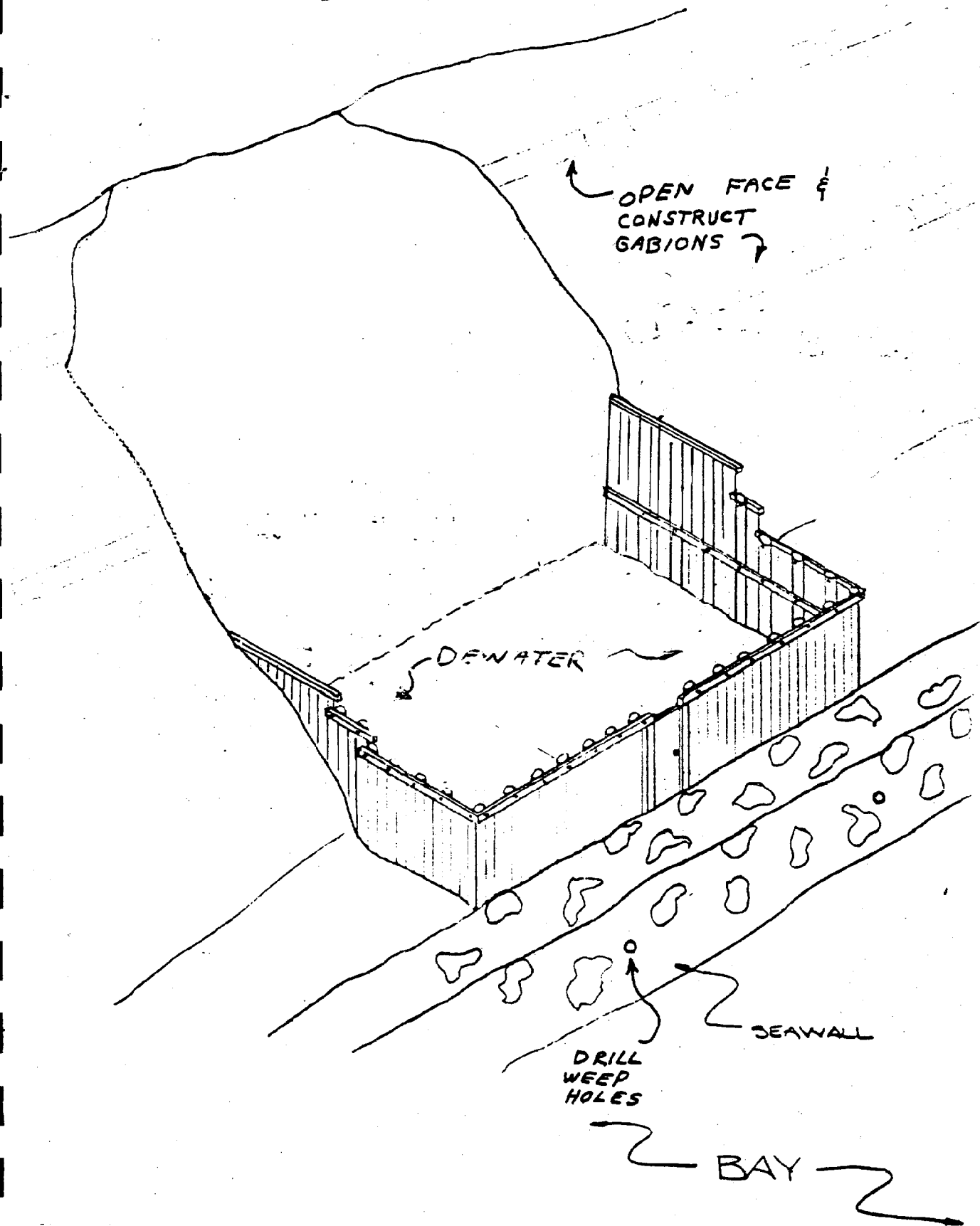


FIGURE 6

STABILIZE ALTERNATIVE 2



D. PUBLIC PURCHASE ALTERNATIVES

A final alternative would be for an appropriate public agency or scientific organization to acquire the residential property or properties at the top of the cliff that are affected by the retreat of the cliff. Conceivably, these structures could be acquired under the State Green Acres Program, or could be incorporated into the present municipal Bayfront Park, with a life tenancy arrangement for the present occupants. The assessed value of the Conway property, block number 382 and lot number 1, is \$5,700 for the property and \$8,300 for the structure. Figure 7 shows the pertinent part of the Aberdeen Township Property tax maps.

III. DESCRIPTION OF THE AFFECTED ENVIRONMENT

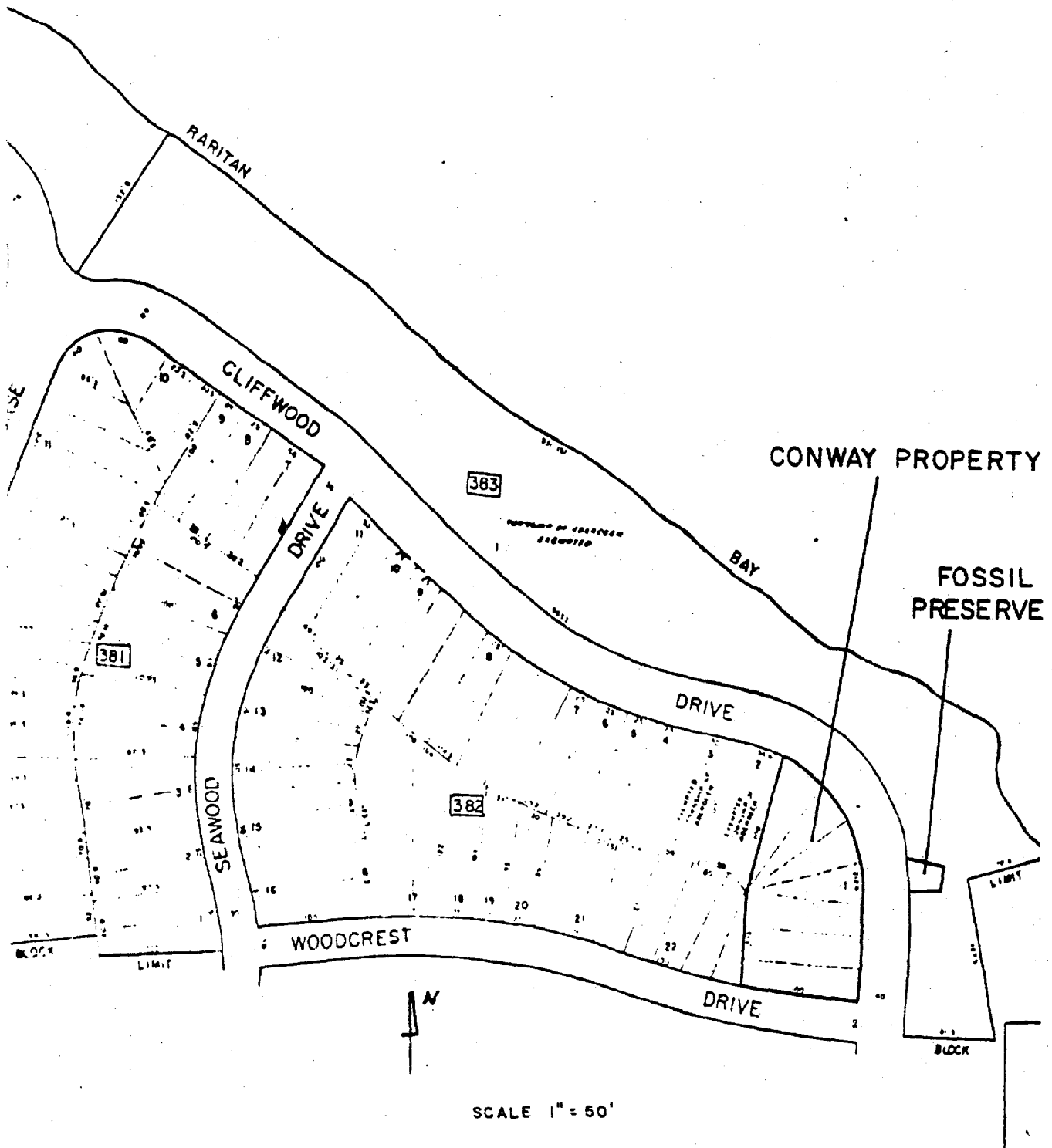
A. History of the Cliffwood Beach Shore Protection Project

Federal, State, and local governmental agencies have focused on the shoreline erosion and accretion processes at Cliffwood Beach for more than 50 years. In 1933, a bill, HR-97, was introduced in the U.S. Congress authorizing the construction of groins and bulkheads for the protection of the beach as well as the high, exposed cliff. At some point before 1935, seven timber groins were built in that area. In 1935, the Township requested that bulkhead and jetties be built to protect the shoreline so that the roadway at Cliffwood Drive not be swept away. Later in 1935, 18 additional timber groins, each 200 feet long, and about 6,000 feet of timber bulkhead were built. All of these structures were generally ineffective in either building a beach or holding the existing sediment in place. In 1951, the Township advised the State that Cliffwood Drive had been undermined and destroyed, and that many homes situated along the bluff were in danger due to erosion. The Township requested that a shore protection plan be developed to protect this area. In 1961, a combined hurricane protection and Shore Protection program was devised by the U.S. Army Corps of Engineers for a strip of Raritan Bay from Cliffwood Beach west. Township officials successfully urged that the protection also be provided in Cliffwood Beach. In 1962, the U.S. Congress authorized construction of a seawall and beachfill at Cliffwood Beach, with up to \$1 million in federal funding through the U.S. Army Corps of Engineers.

In 1968, the Township applied to the State for \$1,800,000 for a multi-phase shore protection project, which the State rejected due to the lack of available funds. The Township applied again in 1969 for the first phase of this project. The general concept of this project involved a stone seawall from Matawan Point west to Whale Creek, with beachfill in front of the seawall. In 1971, the Township authorized its municipal engineers, T&M Associates, to proceed with survey work for the project. In late 1971, the Township applied for State aid for the Shore Protection project. In 1973, the State requested that the Township enter into an official State Aid agreement for this project, which the Township approved on February 20, 1973. The Township agreed to dedicate the lands along Raritan Bay as a public park and agreed to maintain this area. The State approved the Shore Protection project in 1972. Figure 8 shows the various elements of this plan.

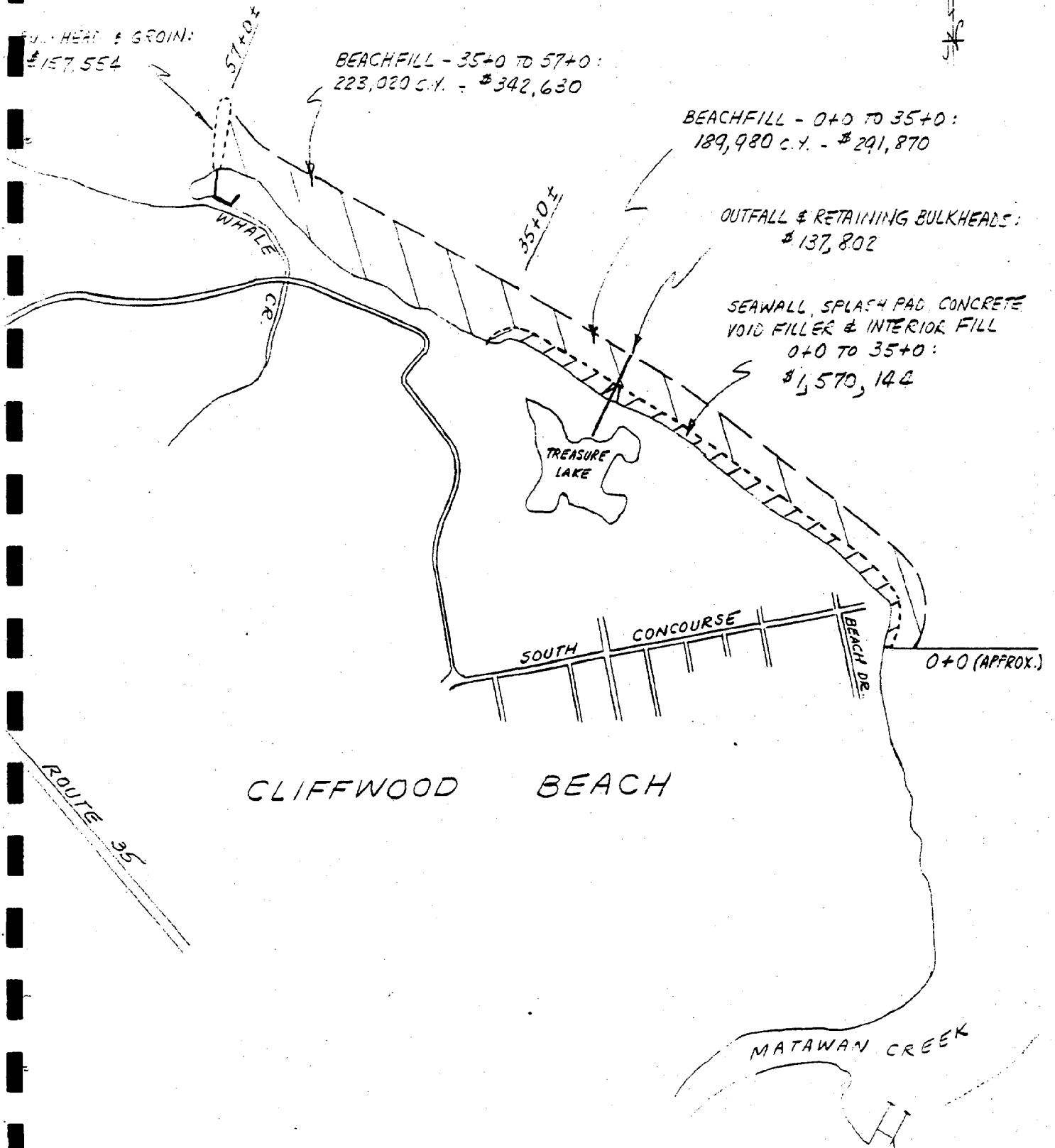
FIGURE 7

PROPERTY TAX MAP OF CONWAY SITE



CLIFFWOOD BEACH SHORE PROTECTION PROJECT SITE PLAN, 1972-1976

1" = 100'



Construction on the first phase of the project, involving 2,450 linear feet of stone seawall, a concrete drainage outfall structure, and the creosoted timber Fossil Preserve, took place between late 1974 and September 23, 1975. Construction of the second phase, involving 939 linear feet of stone steel wall, 168 linear feet of creosoted timber bulkhead along Whale Creek, 230 feet long stone groin at Whale Creek and backfilling, grading and a splash pad along the entire stone seawall, took place in 1976 (See Figure 8).

In November 1979, the State scheduled competitive bidding for the construction of the final phase for the project, the beach fill offshore of the seawall, with filling of the Preserve and construction of a beach and dune system along that portion of the shoreline near Whale Creek. The State received no bids, as contractors could not obtain the required bonding for the more than \$1 million cost of the project. The State then scaled down the project and advertised again for competitive bidding. Upon realizing that the U.S. Army Corps of Engineers permit had expired and that new DEP Rules on Coastal Resources and Development Policies discouraged extensive beachfill, the State, through its Division of Coastal Resources, canceled future rebidding.

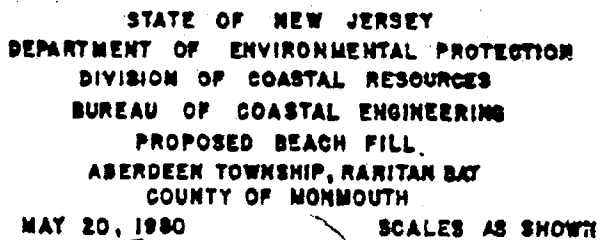
Negotiations then took place during 1980-1981 involving the Township, the State, and the U.S. Army Corps of Engineers on the scaled down beachfill for the project as shown in Figure 9. This culminated in the approval of the required State Waterfront Development and Wetlands Permits on December, 1981 and receipt of the required U.S. Army Corps of Engineers Section 10 and Section 404 Permits in January, 1982. The estimated cost of the beachfill phase of the project is \$1,192,000 of which the State will finance 75%. The required 25% local share will be financed both by Aberdeen Township and Monmouth County, which will contribute up to 15% of the total project cost.

The Cliffwood Beach Shore Protection Project is an approved U.S. Army Corps of Engineers Project for which the State may receive reimbursement, although the modification of the beachfill phase to limit the quantity of beachfill has caused the project to no longer comply with the project as authorized by Congress in 1962. For that reason, the project is no longer eligible for the \$1 million authorized in Federal funds.

B. SHORELINE EROSION AND ACCRETION AT CLIFFWOOD BEACH

Both erosion and accretion have taken place along the Cliffwood Beach shoreline of Raritan Bay. From 1836 to 1856, this reach of the shore gradually eroded, with an average annual erosion rate of about five and one-half feet. At the location of the present Fossil Preserve, the bluff eroded a maximum of 350 feet in this period. Between 1856 and 1886, the shoreline accreted, at an average rate of one foot per year. Deposition of eroded material from the face of the cliff toward Matawan Creek's westerly bank probably caused this build up of the shoreline. The material at the face of the bluff eroded due to natural processes and was then redistributed along the bluff area.

FIGURE 9

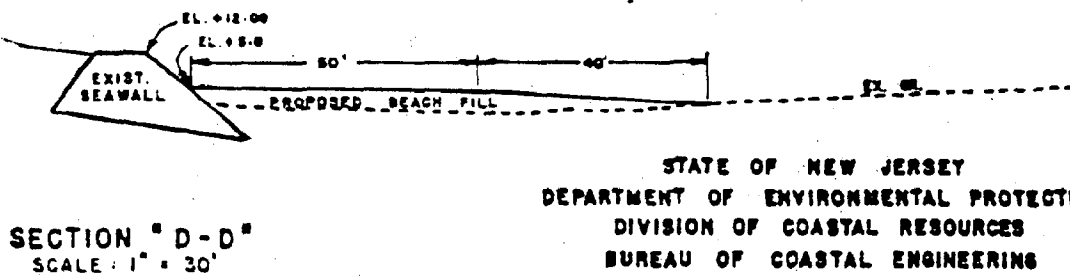
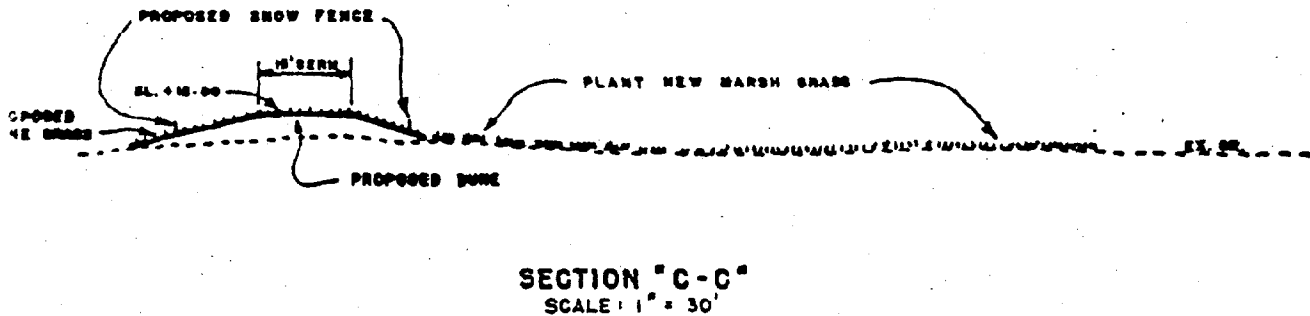
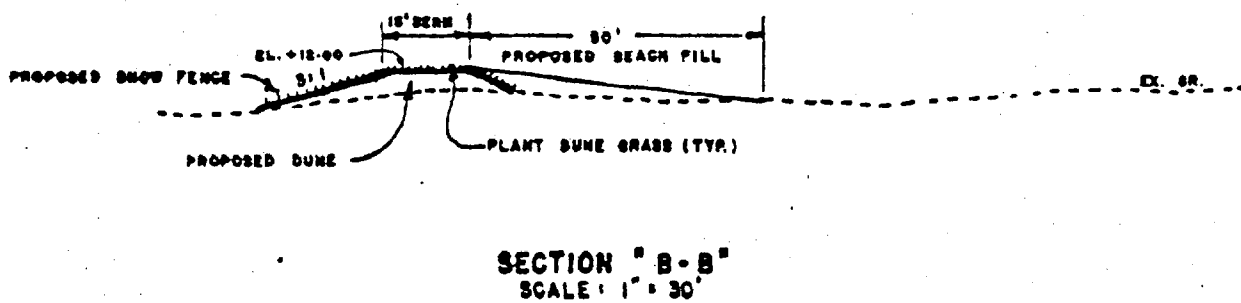
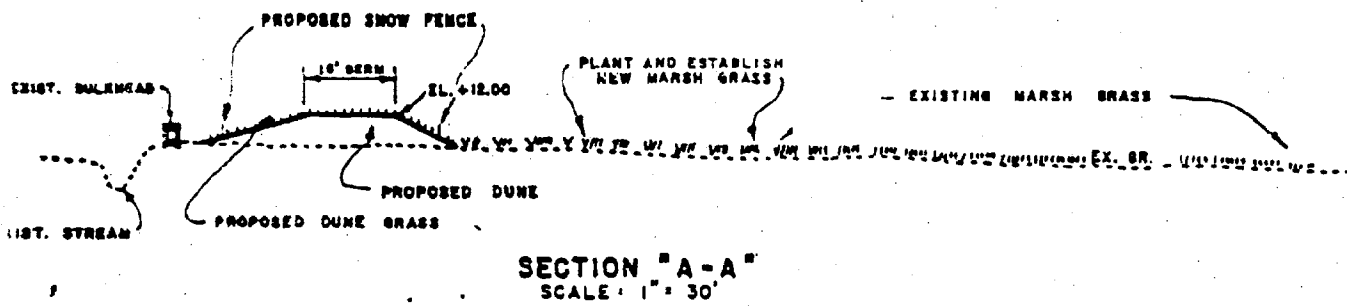


MAY 20, 1980

SCALES AS SHOWN

CHIEF - BUREAU OF MARITIME ENGINEERING

FIGURE 9A



STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF COASTAL RESOURCES
BUREAU OF COASTAL ENGINEERING
PROPOSED BEACH FILL
ABERDEEN TOWNSHIP, RARITAN BAY
COUNTY OF MONMOUTH
MAY 20, 1980
SCALES AS SHOWN

From 1886 to 1926, accretion of an average of one foot per year also took place. Between 1926 and 1934, slight erosion took place. The portion of the shoreline between Lawrence Harbor and Whale Creek, for example, receded 100 to 200 feet.

In brief, from 1836 through 1970, the shoreline eroded at an average rate of one-half foot per year (see Figure 10). The completion of the seawall in 1976 limited further landward erosion.

C. EROSION AND SLUMPING AT THE FOSSIL PRESERVE

While erosion of the bluff itself has been stopped by the sea wall, continued erosion and slumping of the Fossil Preserve has taken place since the construction in 1975. This erosion or slumping can be attributed to at least two causes. First, the backfill material used along the cliff face had a very high clay content. Compaction of the material made the bluff somewhat impervious to stormwater runoff. Creation of the Fossil Preserve provided an easy route of passage, through the face of the bluff. This caused the layer of soil along the open bluff to erode and created small slumps, which resulted in continued retreat on the top of the bluff. Second, seepage appears to take place from at least two points along the exposed cliff face.

Regardless of the causes, significant erosion has taken place in the Fossil Preserve area of the cliff exposure. Between 1973 and 1979, the cliff retreated by 6 feet (see Figure 11).

D. THE SCIENTIFIC VALUE OF THE CLIFFWOOD BEACH FOSSIL EXPOSURE AND PRESERVE

The Mesozoic Upper Cretaceous Magothy Formation exposure at Cliffwood Beach has been known since the time of State Geologist Cook in 1858. In the past 75 years, this site has attained international renown because of the excellent state of preservation of its fossils, the range of plant and animal groups represented, and the abundance of evidence for "reconstructing" the paleoenvironment of 100 million years ago.

The origins of the Fossil Preserve are murky at best. In 1973, T&M Associates, Township Engineers, advised the Township that the area should not be preserved, and rather should be filled. The State, through the then Bureau of Navigation, held the same view. The State Geologist in DEP apparently also held the same view. Nevertheless, the Township Council in 1973 presumably decided to establish the Fossil Preserve, and the State accepted the local decision.

The Cliffwood Beach Fossil exposure includes paleobotanical material comprising microscopic pollen and spores and megascopic leaves, bark, stems, and cones. Faunal material found at the site includes invertebrates such as bivalve molluscs, crustaceans, and chordates such as turtles and some fish. It is important to stress that no insects have been discovered at the Fossil Preserve site. Some very famous primitive ants preserved in amber were discovered about a mile east of the Fossil Preserve.

FIGURE 10

SHORELINE CHANGE

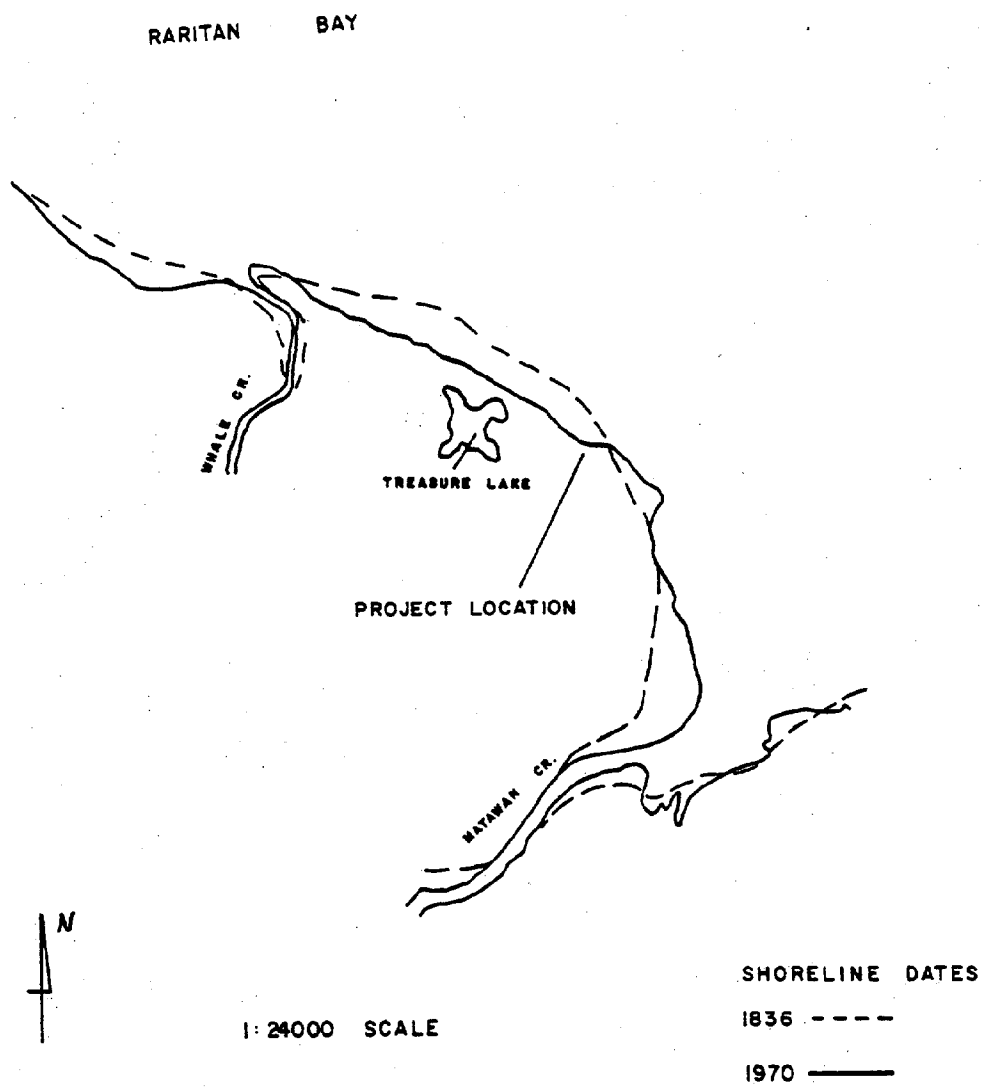
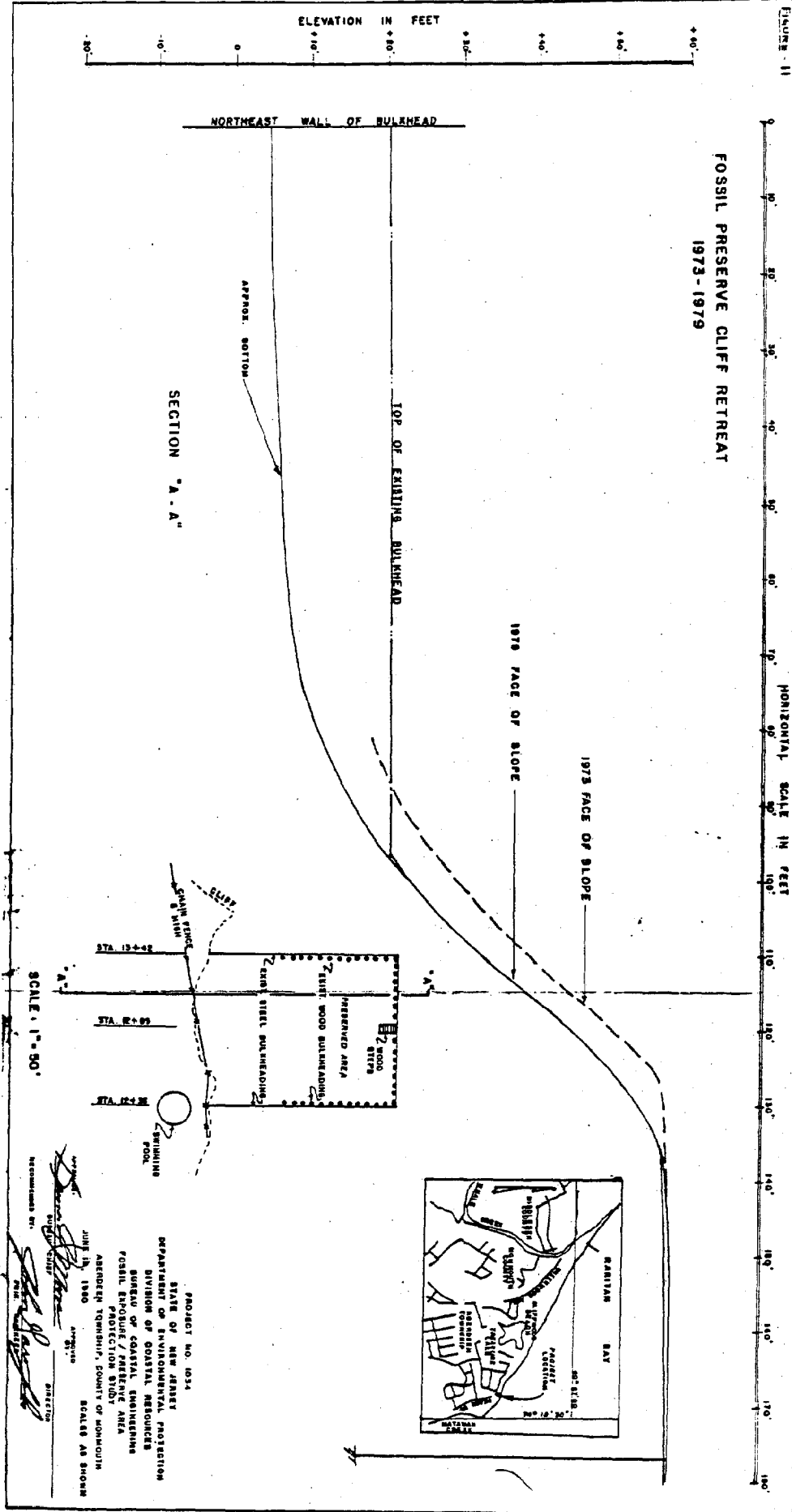


Figure 11

FOSSIL PRESERVE CLIFF RETREAT 1973-1979



Cliffwood Beach is the type locality for a number of new species and genera of fossil plants and animals ancestral to taxa which became prominent or dominant in the Cenozoic, some of which have survived into the Recent.

Exposures of Upper Cretaceous Age are understandably scarce in eastern North America. Mining for clay, sand, gravel and ilmenite, plus construction of roads, residential developments and industrial plants have destroyed these fossiliferous exposures. Cliffwood Beach is unique among Upper Cretaceous fossil-bearing sites because of the formation of its layers. Biogeostratigraphers interpret its sediments to "reconstruct" the details of ancient environments in which plants and animal lived, as their remains are preserved at this site in fossil form. This knowledge has contemporary relevance when, for example, the zoning of the sediments extracted from exploratory drilling for offshore oil and gas in the Baltimore Canyon area off New Jersey in the Coastal Offshore Stratigraphic Test (COST) Well B-1 and B-2 was based upon a biostratigraphic framework formulated from Cliffwood Beach paleontology.

Cliffwood Beach has been a standard field trip destination for undergraduate and graduate geology students in New Jersey universities for at least the last 50 years. In addition, it has been a stop on excursions conducted by the regional meetings of the Geological Society of America and for International Geological congresses when held in the Northeast.

Many of the fossil specimens collected decades ago are now disappearing as they are fossilized as iron pyrites with a high moisture content. In the air, this mineral forms sulphuric acid which disintegrates the fossil, eats away the label and containers and has even perforated storage drawers. In short, the recollection of fossil samples is now very important to replenish collections.

Also, through improvements in analytical technology, the study of the fine structure of leaf surfaces has now become possible. Fresh knowledge on the Mesozoic evolution of flowering plants is now possible through studies of the conifer and broad-leaved families in the Cretaceous strata at Cliffwood Beach. Samples from the site have already led to a radical revision of evolutionary timetable for the Angiosperm.

In addition, in late 1980, the State sent a letter of inquiry to geologists and paleontologists around the country with past interest in the Cliffwood Beach Fossil Exposure to seek their comments on the scientific value of the Cliffwood locality, their views on the desirability of and possible justification for maintaining access to the exposures, and suggestions on methods to slow or stop slumping of the cliff face. These letters are reproduced in full in Appendix B of this report. In summary, the Cliffwood Beach Fossil Exposure is of clear scientific value, although the accessibility of the site for collection has been reduced as a result of the erosion and slumping that has filled in the box with a soupy, muddy material, covering up the lower, most productive fossiliferous strata of the exposure.

IV. ENVIRONMENTAL CONSEQUENCES

Each of the four alternatives outlined above will have consequences on the built, natural, social, human and economic environment.

The fill alternative, if implemented, will remedy the present problem of retreat of the cliff, which has threatened the chain link fence at the boundary of the Conway property, has required the above ground swimming pool to be removed landward, and could eventually, threaten the Conway house. The fill alternative will also reduce the hazard to the public safety associated with the wooden box hole which has filled with a soupy, quicksand-like material, up to 15 feet in depth, into which children, shopping carts and other materials have fallen. Finally, the fill alternative will eliminate the sink that has attracted sheet flow stormwater runoff from both sides of the portion of the cliff face to be filled. However, the fill alternative will also eliminate reduce the accessibility of the fossil exposure to the scientific community for collection and field trip purposes. The local government will also no longer face the prospect of maintenance costs for the Fossil Preserve since it will no longer exist.

The salvage then fill alternative has the same long term consequences as the fill alternative, with the benefit to the scientific community of a final opportunity to collect fossils and record that investigation through the preparation of a scientific report, creation of a display cabinet with new materials, and publication for the scientific community of the results of this investigation.

The stabilize alternative is the most costly, requires the most engineering, and faces the greatest number of legal and financial unknowns, through the land acquisition alternatives for the structure and property on top of the cliff. A detailed engineering study would be needed to explore any stabilization alternatives, including those to shelter the fossil exposure to make it more accessible to the scientific community. Neither alternative could ensure prevention of erosion or improvement of the previous conditions at the preserve. It is not clear today that any government agency is willing and able to accept the financial responsibility for improving and maintaining accessibility to the lower formation of the cliff and fossil exposure. Nor is it clear that any governmental agency or private institution is willing to accept responsibility for acquisition of the property and structures at the top of the cliff. Acquisition of property would not halt the erosion process which, due to the lack of engineering, would begin to endanger neighboring properties.

The U.S. Department of Interior is conducting, as part of its National Natural Landmarks Program, a survey of potential natural landmarks that would qualify for national natural landmark designation. The principal investigator, Ms. Carol Shifflett, will be

recommending the Cliffwood Beach site as a potential national natural landmark. However, the designation process may take several years and the funding status of this program at present is uncertain at best. The swift erosion rate of one foot per year at the cliff precludes such a time-consuming alternative.

Similarly, there is no governmental agency presently willing and able to acquire the properties at the clifftop so that they would not have to be protected from erosion. If no steps other than public acquisition are taken, erosion will continue, affecting both the Conway property and adjoining cliff top properties.

V. CONSULTATION AND COORDINATION

Determining the fate of the Fossil Preserve at Cliffwood Beach, built as part of the 50 year old effort to protect this part of the shoreline of Raritan Bay, has involved consultation and coordination, particularly over the last decade, with numerous federal, state, and local governmental officials, university researchers and scholars, and other scientific institutions. The origins of the effort to preserve the fossil exposure are, despite the benefit of extensive files, difficult to pinpoint, without more thorough research than has been possible for this study. It suffices to note that government, at the Township and State levels, decided in 1973 to preserve part of the fossil exposure, then designed the Fossil Preserve and built and shared its cost. The Township then paid the entire cost of the maintenance of the Fossil Preserve after it was once set on fire by vandals. Government, through the governing body of the Township of Aberdeen, has now expressed a different view on the fate of the Preserve and wishes that it be filled promptly. Government, through DEP's Division of Coastal Resources, has undertaken this Environmental Assessment and consulted with the scientific community to ascertain the value of the fossil exposure and identified the consequence of alternative fates for the Preserve. Appendix B reproduces in full the letters recently received from the scientific community.

IV. CONCLUSION, RECOMMENDATION, AND DECISION

Public decisions on environmental resources often involve a balancing of short and long term perspectives and of both local and more general perceptions of the public interest. This is exactly the case with the fate of the Cliffwood Beach Fossil Exposure and the Preserve created in the mid 1970's.

While the Preserve was apparently originally created at the request of the sponsoring Township, the Township now has changed its mind and wishes that the Preserve be eliminated through filling. The State has certain obligations as the steward of the environmental resources of the state. While scientists may differ as to the value of the Fossil Preserve, it appears unquestioned that this is a very useful site of fossils, helping scientists understand more of the origins of the earth. Because a fresh collection of fossils is necessary, the "salvage then fill" alternative appears to provide a reasonable balance between the short term, local interests

of the Township, and the longer term, broader interests of the State. This Assessment concludes, therefore, that the salvage then fill alternative makes the most sense and should be implemented as part of the completion of the Cliffwood Beach Shore Protection Project.

To carry out the "salvage then fill" alternative, the Division of Coastal Resources has applied for and received federal funds through a supplement to its annual Coastal Management Program Implementation Grant for a study, at a cost not to exceed \$10,000, to collect, analyze and prepare a scientific report on the fossils at the Cliffwood Beach site, before the Preserve is filled as part of the Shore Protection Project. The State will contract with the Center for Coastal and Environmental Studies at Rutgers-the State University to undertake this project. The plans and specifications for the beachfill phase of the Shore Protection Project will require that the Preserve be excavated, carefully and sufficiently, to expose the lowest, productive fossiliferous levels of the cliff. Scientists will be notified of this project and will be afforded the opportunity to participate at the excavation to gather samples or request a sample of a certain size or weight be collected for them and shipped to them at their expense. Materials will be collected for analysis and preservation under the direction of Rutgers scientists, Dr. Norbert P. Psuty and Dr. Richard K. Olsson, with assistance from professors and graduate students. A display cabinet will be prepared and placed on exhibit at the Rutgers museum with examples and descriptions of the materials collected at Cliffwood Beach. Materials not displayed will be identified, labelled, preserved and stored. A final, written report, suitable for publication in a scientific journal will describe the mitigation project and its results. Once adequate samples have been collected, the Preserve will be filled according to plans and specification based upon the engineering and soils studies done by Raamot Associates in 1979.

APPENDICES

A. List of Preparers of the Environmental Assessment

The authors of this environmental assessment are:

David N. Kinsey, Director
Division of Coastal Resources
New Jersey Department of Environmental Protection

Lawrence Schmidt, Chief
Office of Cultural and Environmental Services
New Jersey Department of Environmental Protection

Jonathan Gell
Principal Environmental Specialist - Archaeology
Office of Cultural and Environmental Services
New Jersey Department of Environmental Protection

Bernard Moore, Chief
Bureau of Coastal Engineering
Division of Coastal Resources
New Jersey Department of Environmental Protection

John Garafolo
Principal Hydrographic Engineer
Bureau of Coastal Engineering
Division of Coastal Resources
New Jersey Department of Environmental Protection

While all five authors contributed to this assessment, the responsibility for its conclusion and decision rest with David N. Kinsey, Director, Division of Coastal Resources, the agency responsible for New Jersey's Shore Protection Program.

APPENDICES

- B. Letters from the Scientific Community on the
Cliffwood Beach Fossil Exposure.



United States Department of the Interior
HERITAGE CONSERVATION AND RECREATION SERVICE

WASHINGTON, D.C. 20243

IN REPLY REFER TO:

W340

Mr. David N. Kinsey
Director, Division of Coastal Resources
Department of Environmental Protection
P.O. Box 1889
Trenton, New Jersey 08625

Dear Mr. Kinsey:

Thank you for your letter of December 1 to Mr. Francis Ugolini on the Clifford Beach Fossil Exposure in Monmouth County, New Jersey. We are ~~very sorry for this late reply.~~

You asked for our comment on the scientific value of the Clifford Beach site from the standpoint of our agency's expertise or programs. The National Natural Landmarks Program, administered by the Heritage Conservation and Recreation Service (HCRS), relates directly to natural areas like the Clifford Beach site. As described in the enclosed brochure, the Secretary of the Interior established the natural landmarks program to identify and encourage the preservation of the full range of ecological and geological features that are nationally significant examples of the Nation's natural heritage.

HCRS conducts studies of the natural features of each of the natural regions of the United States to provide a logical and scientific basis for designating natural landmarks. The Clifford Beach site is located in the Atlantic Coastal Plain natural region. A study of the geological sites in this region is being done for us by the U.S. Geological Survey and is now in final draft. This study will produce a list of potential natural landmarks which the principal investigator believes qualify for designation. We have conferred with the principal investigator, Ms. Carol Shifflett, and she told us that she will recommend the Clifford Beach site as a potential natural landmark.

Ms. Shifflett described the site as follows:

"Outstanding outcrop of the Magothy Formation unique along the Atlantic Coastal Plain in terms of stratigraphy and fossils. Similar sites are found only in the Gulf Coastal Plain. Invertebrate fossils for which the bluffs at Cliffwood ... serve as the type locality include the following: nine species of bivalves, two species of gastropods, and one species of crustaceans. The outcrop is most valuable for the rare and extensive assemblage of

Mr. David N. Kensey

2

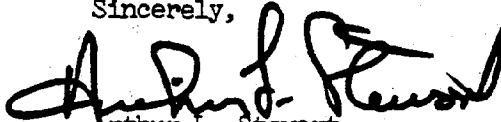
plant fossils totalling around 100 species and including leaves, wood, fruits and cones. In addition to the above, the earliest representatives of the true ants have been found in amber derived from the Magothy Formation at Cliffwood by Professor Carpenter at Harvard University, according to Norman F. Sohl of the U.S. Geological Survey."

After the natural region study is completed, HCRS will further evaluate the area by having an onsite evaluation study completed by another geologist. This is a lengthy process which can take at least another year to complete because of the large number of potential landmarks we need to evaluate with limited funds.

We appreciate the State of New Jersey's concern for its natural heritage by considering the preservation of the Clifford Beach Fossil Exposure as an option in the proposed shore protection project.

We will be happy to provide any further information you may require.

Sincerely,



Arthur L. Stewart
Chief, Division of State
Heritage Programs



United States Department of the Interior

GEOLOGICAL SURVEY

Mr. David N. Kinsey, Director
Dept. of Environ. Protection
P. O. Box 1889
Trenton, N. J. 08625

Feb. 16, 1981

Dear Mr. Kinsey:

Orrin Pilkey referred your letter to me as I am more acquainted with fossil localities. I have not personally visited this locality but I am extremely familiar with situations which are apparently similar to the one you describe. I have discussed the setting with others who have been to this locality. I offer the following comments.

The locality at Clifford Beach is apparently unique as it is the only exposure of latest Santonian age deposits along the entire Atlantic Coast. Amber in this outcrop contains a record of the first appearances of certain modern insects. The outcrop is certainly worth saving but this would probably mean buying the property and letting active erosion maintain a clean outcrop.

If a bulkhead has been built, it is probable that the outcrop will soon be slumped over with debris and vegetation.

The fate of the house depends on the height of the cliff. Over a period of time the cliff is going to assume a natural angle of repose even if all removal of slump at the base of the cliff has been stopped by the bulkhead.

We have been fortunate not to have had major hurricane erosion in this area for over 10 years. However a significant hurricane can push large amounts of water into these tidal areas, water levels can be far above normal, and the waves can do tremendous erosion in these instances. Such an event can generally be expected to remove the accumulation of slumped sediment from the base of the cliff and to start a new cycle of erosion by creating a vertical cliff. I have seen the face of an eighty foot high river cliff recede ten feet during a hurricane generated storm.

In summary, the best way to preserve the outcrop is generally to let erosion take its course. The best way to preserve the house is to use jetties and bulkheads.

Sincerely yours,

Blake W. Blackwelder
Blake W. Blackwelder
R-501 N. S. Geological Survey
Washington, D. C. 20560



United States Department of the Interior

GEOLOGICAL SURVEY

E-501 Museum of Natural History, Washington, D.C.
20560

Mr. David N. Kinsey
Division of Coastal Resources
Department of Environmental Protection
P.O. Box 1889
Trenton, New Jersey 08625

Dear Mr. Kinsey:

I am in receipt of your excellent letter of December 1, 1980. As I tried to make clear previously, although my office is in the Museum of Natural History, I am an employee of the Department of Interior. So long as this is an official inquiry, officially I have no comment. As a practicing paleontologist I have my private views, but private views and official comments are not the same.

Your good letter will be forwarded to others who may comment on it.

Cordially yours,


Ellis L. Yochelson



ONE HUNDRED YEARS OF EARTH SCIENCE IN THE PUBLIC SERVICE



American Museum of Natural History

DEPARTMENT OF
VERTEBRATE PALEONTOLOGY

December 30, 1980

Mr. David N. Kinsey
Department of Environmental Protection
P. O. Box 1889
Trenton, New Jersey 08635

Dear Mr. Kinsey

Please excuse the delay in replying to your letter of December 1, but I have been out of town.

I would strongly support some type of program that would allow continued access to the Cliffwood Beach exposure of the Magothy Formation. Although it might seem like another example of some trivial scientific matter that is preventing the completion of an economic necessity, I do not think that this is the case. Understanding of New Jersey geology has become an extremely important topic in these days of ground water contamination by toxic wastes. Fossil-yielding exposures (indeed any exposures) of the Magothy are rare but very important in determining its age and stratigraphic relationships. The Magothy is an important but poorly understood clay-bearing formation that has a significant influence on ground water.

The fossils from the Magothy Formation are unusual and very interesting. In the enclosed paper I have described a brain-skull cast of a very rare turtle from Cliffwood Beach. Study of fossils of this sort are the basis for determining the stratigraphic relation of the Magothy. It would be very important to maintain access to Magothy exposures so that new fossils can be found and new techniques used to study its geology.

As I have no real information about the legal - governmental situation at the locality it is hard for me to offer suggestions for resolving it. I have visited the site a number of times in the past but not recently.

If I can answer any questions you may have, please feel free to let me know.

Sincerely,

Eugene S. Gaffney
Eugene S. Gaffney
Curator

ESG:bw



State of New Jersey

NEW JERSEY STATE MUSEUM
DEPARTMENT OF EDUCATION
205 WEST STATE STREET P. O. BOX 1868
CULTURAL CENTER
TRENTON, N. J. 08625

December 8, 1980

David N. Kinsey, Director
Division of Coastal Resources
Department of Environmental Protection
P.O. Box 1889
Trenton, NJ 08625

Dear Dr. Kinsey:

With regard to the Cliffwood Beach fossil locality, this museum has no current research nor collecting efforts planned for the site. We are the repository for a number of significant specimens, including type specimens, which were collected at Cliffwood Beach, but there are no plans to collect more specimens.

At the time I was first asked about the locality in 1973, it was of some importance for instruction of geology students. For example, Professor Erling Dorf, now retired from Princeton University, visited Cliffwood Beach with graduate and undergraduate students from time to time. At least several amateur paleontologists were interested in the locality, and Professor Charles Miller (University of Montana) had active research on plant fossils from Cliffwood Beach. All of the above activities existed despite the unfortunate environment which then prevailed. I do not know if any of these activities continue there, since none of the above-mentioned people have discussed the site with me.

We have visited the site occasionally since then, and have recovered a few fossils from there, but we have no plans to exploit it. As with all beach frontage sites, the potential damage to private property makes extensive collecting difficult, controversial, and possibly hazardous.

It is, of course, most regrettable that this site has become a controversy. At the time I visited and identified exposures there (which I confirmed by collecting a few fossils), I was assured that the engineering problems of maintaining the exposure could be solved, and that, in fact, some construction money could be saved by leaving an area exposed. The site had (and still has) some historical importance to paleontologists (since type specimens of fossil crabs and plants had been collected there) which certainly was a consideration in preserving it. However, it appears that some engineering aspects of preservation of the site have not been solved. Not being an engineer, I cannot offer any suggestions for further stabilization. Nor can I offer any reason why it should not be filled and covered, based on this museum's interests. Covering it will not destroy fossils, but will simply make them inaccessible. If property and physical safety are threatened by the current status of this site, I could scarcely protest any efforts to cover it. This museum cannot commit any resources for management nor protection of the site.

Of course, the opinions I have expressed above only apply to this museum's interests. There may be other researchers, for example, at Rutgers University,

who have an active interest in the site, and whose opinions you no doubt are seeking. I will be happy to discuss the site if further information is desired, or if you feel that I have not fully answered your questions.

Sincerely yours,

David C. Parris

David C. Parris
Assitant Curator
Natural Science

DCP/dcb

State of Delaware
DELAWARE GEOLOGICAL SURVEY
UNIVERSITY OF DELAWARE
Newark, Delaware
19711

ROBERT R. JORDAN, STATE GEOLOGIST
101 PENNY HALL
PHONE: 302-738-2833, 2834

December 9, 1980

Mr. David N. Kinsey, Director
Department of Environmental Protection
P.O. Box 1889
Trenton, NJ 08625

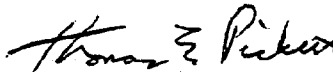
Dear Mr. Kinsey:

This is in reply to your letter of December 1, 1980
on the Clifford Beach Fossil Exposure.

Unfortunately I have no knowledge of this locality
or the efforts to preserve the site.

The efforts to preserve the "Biggs Farm" locality at
the Chesapeake and Delaware Canal by use of steel bulkheads
was largely unsuccessful. The outcrop eroded to a pile of
sand still affected by the tide, in spite of enclosure by
bulkheads on three sides.

Sincerely,



Thomas E. Pickett
Associate Director

TEP:dcw

Yale University

DEPARTMENT OF BIOLOGY

Osborn Memorial Laboratory

P.O. Box 6666

260 Whitney Avenue

New Haven, Connecticut 06511

December 10, 1980

Mr. David N. Kinsey
Director, State of New Jersey
Department of Environmental Protection
P.O. Box 1889
Trenton, NJ 08625

RE: Cliffwood Beach exposure
Aberdeen Township
Monmouth County, NJ

Dear Mr. Kinsey:

Thank you for your letter of December first soliciting my thoughts on the Cliffwood beach site. You pose three questions: scientific value, methods of preserving the site, and potential monetary support for its preservation. Let me answer each in turn, and in so doing, draw heavily on a letter which I wrote to Mr. Bernard Moore (Office of Shore Protection, Division of Marine Services, N.J. Dept. of Environmental Protection) on January 31, 1979.

Scientific Value

The paleobotanical content of the Cliffwood locality was first determined by E. W. Berry in the early portion of this century, and his subsequent publications on the flora (see appended bibliography) made it famous among angiosperm paleobotanists throughout the world. Mr. Berry worked primarily on leaves, and in the 70-odd years since his research on the Cliffwood flora, our understanding of fossil leaves has increased enormously. Thus, the Cliffwood leaf flora is "ripe" for a reinvestigation using modern techniques. At the present time, I have a graduate student who is just about to commence active research, and who has expressed some interest in just this project. The site should be kept open for this purpose. In addition, Mr. Berry did not pay any particular attention to the fruits, seeds and wood found in the organic bands at the site. Preliminary research on my part reveals that all three types of fossils are present in quantity, and form an important body of paleontological evidence. It is thus desirable that the site remain available so that this material can also be investigated in detail. While I have collected some material, much more would have to be gathered over a period of several years to do the job properly. I would also mention that several studies have

been done on fossil pollen from this site. I am not personally familiar with this work, so I cannot say how "complete" it is at present. I suggest that you might wish to solicit the opinion of a professional palynologist in this matter. Finally, I would like to emphasize the fact that ^{the} a fossil locality has been collected, ^{it} does not mean that it is of no further value. As the example of the leaves (above) demonstrates, we learn more of the techniques of science as time passes. For classic localities, such as Cliffwood Beach, this means that a re-investigation of the site about every fifty years is a very profitable and appropriate undertaking.

The Cliffwood site is also of considerable educational value. I have taken classes from Yale to the site to show them the nature of plant fossilization and lignitic preservation. The locality permits the students to see and collect fossils first-hand. It is really the only available site for collecting plants of this age in the New York-New England area, and its proximity to the urban and scholastic centers of the Northeast enhances this value. While my interests lie with fossil plants, I would observe that the Merchantville Formation beds, which cap the cliff at this site, harbour a classic marine invertebrate fauna which has been of considerable teaching and research interest to invertebrate paleontologists. Again, you might wish to contact an invertebrate paleontologist for a professional opinion of the value of the site. Finally, I believe that the Cliffwood Beach exposure is the "type" section of the Cliffwood beds of the Magothy Formation, and thus has a quasi-legal importance in the geological literature. In this respect, it is of importance to the geologic community as a whole that some portion of the cliff be left bare and available for inspection.

Preservation of the site

It has been gratifying to scientists to note that the State of New Jersey had the foresight to cession off one small area of the cliff when the initial back filling was done. In view of the expense involved in that initial action, it would be a shame to cancel it by filling the pit in. I am given to understand that the pressure for back filling this window comes from the landowner on its shoreward side, and is occasioned by continual erosion of the seaward face of his/her property adjacent to the pit. While I do not think that the course of nature can be halted, it can be slowed.

The present problem of erosion is primarily due to soil moisture and associated frost action. Two specific steps may be taken to reduce the amount of soil water at the base of the cliff and within it. First, the cession is (in my experience) filled with water, which is thus held against the cliff. Installation of a drain at a fairly low level on the seaward face of the cession would dry this "pond" out. The main problem lies in keeping the drain open, so it might have to be maintained on a yearly schedule. Second, and more annoying, there is a source of moisture in the cliff, one which is caused by a sewerage pipe from (I assume) the adjacent property. This pipe provides constant moisture on the face of the cliff, and looks so old and rotten as to make me suspect that it leaks along its entire course. If the pipe has to remain in place, it should be replaced by an impervious pipe which extends well beyond the cliff face (if indeed such a sewerage outfall is legal in the first place!). If the pipe drains a leaching field, said field should be moved

Mr. David N. Kinsey

-3-

December 10, 1980

immediately to some site where it would not contribute directly to the soil moisture in the cliff.

A third solution is also possible - one which would be (I suspect) cheaper than any back filling project! This would involve purchasing the house, leveling it, and letting mother nature take her course. This would be, in my opinion, the most cost-efficient solution, and would thus satisfy the state treasury and science simultaneously. The central problem here is, does the owner wish to move? If the decision were made not to backfill the cassion, I would assume that he/she would accent a fairly appraised sum for the property rather than watching his/her investment wash down to the sea.

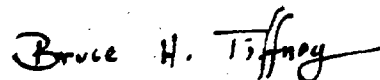
Funding/Status of site

Again, I argue that the cheapest solution (including filling the cassion) would likely be to purchase the property. If the state would not care to maintain it as a scientific preserve, open to scientists (a potentially unique and innovative act), it could be donated or sold to an organization such as the Nature Conservancy for this purpose. Alternatively, I would think that you might approach the Dept. of Geology at Rutgers to see if they would care to oversee the site was a state-established scientific preserve. I know that Yale supports such sites within the State of Connecticut for the purposes of Science, and Rutgers could well serve this function in New Jersey. As to funds, I do not have any immediately to hand to call upon or suggest, but again the Nature Conservancy, or perhaps the Trustees of Reservations, might be approached with this question.

In conclusion, I strongly urge that the state preserve this site as a locality of great scientific value. I would be very happy to provide you with the names of other scientists interested in this site, if you would care to solicit their opinions. Finally, I would appreciate being kept posted on the status of this problem. If all fails, and backfilling is scheduled, a team of paleontologists should be warned so that as complete as possible a record of the site can be made. However, it would be far more heartening to think that this type of "salvage science" will not be necessary, and that the Cliffwood site will remain as a window into the natural heritage of our country.

Please do not hesitate to contact me if you have questions, or if I can be of assistance.

Yours truly,



Bruce H. Tiffney
Asst. Professor and Curator
of the Paleobotanical Collections
of the Peabody Museum

BHT/kak

University of Montana
Missoula, Montana 59812

December 10, 1980

Mr. David N. Kinsey, Director
State of New Jersey
Division of Coastal Resources
Departmental of Environmental Protection
P.O. Box 1889
Trenton, NJ 08625

Dear Mr. Kinsey:

Thank you for keeping me informed about plans for the Cliffwood fossil site.

I last visited the Cliffwood locality about ten years ago, and I have no plans to return in the near future. However, I have already published two reports in scientific journals based on Cliffwood fossils. Mr. C. A. LaPasha, my doctoral student, and I will have another report published in the American Journal of Botany next fall. In addition, I have material awaiting study for one more report. Thus, the scientific value of the Cliffwood fossils to my area of specialization is very substantial, and I would not like to see the locality rendered forevermore inaccessible.

From the standpoint of pure advocacy of the scientific merits of the site and if we had sufficient funds available, I would suggest the ideal solution from my standpoint would be for New Jersey to purchase the property that is endangered at the top of the cliff and let nature take its course. The more erosion, the better for collecting fossils!

A more practical solution would be to collect fossils from as much of the remaining cliff as possible without unnecessarily endangering private property, and then cover the site. Collecting should, at the very least, be supervised by a professional paleobotanist, and the fossils should be stockpiled in a state or university collection where interested investigators could study them.

No, I don't have any money to contribute to the project.

Mr. David N. Kinsey, Director

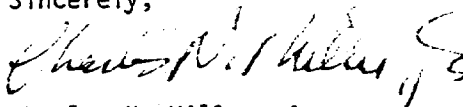
Page 2

December 10, 1980

I hope you will contact Professor Andrew Kasper, Department of Botany, Rutgers University, Newark, and Professor Bruce Tiffney, Department of Biology, Yale University, New Haven.

I would appreciate it if you would continue to keep me informed of plans regarding the Cliffwood site.

Sincerely,



Charles N. Miller, Jr.
Professor of Botany

CM:co

Princeton University

DEPARTMENT OF GEOLOGICAL AND GEOPHYSICAL SCIENCES

GUYOT HALL, PRINCETON, NEW JERSEY 08544

PHONE: 609-452-4101

May 19, 1980

Mr. David Kinsey, Director
Division of Coastal Resources
Department of Environmental Protection
P.O. Box 1889
Trenton, New Jersey 08625

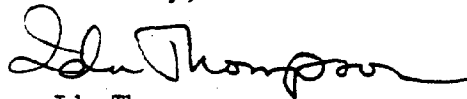
Re: Save Cliffwood Beach
for fossil collecting

Dear Mr. Kinsey:

The best exposure of the Magothy formation occurs in the cliff at Cliffwood Beach, Monmouth County, New Jersey. The lowermost part of the cliff consists of the Magothy sands and clays. As the cliff is eroded back, fossils weather out of the clay strata and collect on the beach. An amazing variety of well-preserved fossil organisms can be found, including cephalopods, crustaceans, pine cones, and over ten species of clams. Historically, this has been an important sight for the study of ancient life in New Jersey. Now the cliff is visited by field trips from every college and university in New Jersey that teaches paleontology or historical geology, including Princeton University.

If erosion of the cliff is prevented, the supply of fossils will stop and the value of the locality will be lost. Please try to stop any interference with natural weathering of the cliff!

Sincerely,



Ida Thompson
Assistant Professor

IT:jo

Princeton University

DEPARTMENT OF GEOLOGICAL AND GEOPHYSICAL SCIENCES

GUYOT HALL, PRINCETON, NEW JERSEY 08544

PHONE: 609-452-4101

December 10, 1980

Mr. David N. Kinsey, Director
Dept. of Environmental Protection
Division of Coastal Resources
P.O. Box 1889
Trenton, NJ 08625

Dear Mr. Kinsey:

In reply to your letter regarding the Cliffwood Beach fossil locality:

Prior to my retirement in June 1974 I visited this widely "famous" fossil locality 3 or 4 times every year for 48 years with undergraduate and graduate students in our department here.

We collected mainly pyritized and carbonized wood and conifer cones from the Late Cretaceous Magothy formation. These fossils are very rare, occurring nowhere else in the United States. Also as rare are occasional concretions containing remains of crabs. These are all, of course, extinct fossils, dating back about 100,000,000 years.

During the past, in connection with scientific meetings, I have also escorted both foreign and American paleontologists to the Cliffwood Beach locality. They were greatly impressed by the fossils there.

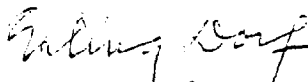
In my opinion, it would be a scientific disaster to do anything to cover up the natural slope, rendering it unavailable to geologists and paleontologists in the future.

Unfortunately, I know of no way to stop the sea from continuing to cut into the steep slope at Cliffwood beach. They tried it in the 1930's by building a concrete wall along the base of the cliff. This, of course, was soon destroyed by storm-wave action.

My suggestion, of course, is to inform the owner of the house on the crest to have his house moved farther inland, with or without financial assistance from the state, which should make the fossil locality a "historic landmark".

If I can be of further help, please let me know by letter or phone (609-452-4095).

Sincerely yours,



Erling Dorf
Professor of Geology Emeritus

Princeton University

DEPARTMENT OF GEOLOGICAL AND GEOPHYSICAL SCIENCES

GUYOT HALL, PRINCETON, NEW JERSEY 08544

PHONE: 609-452-4102

6 December 1980

David N. Kinsey, Director
Division of Coastal Resources
Department of Environmental Protection
P. O. Box 1889
Trenton, New Jersey 08625

Dear Mr. Kinsey:

Your courtesy in consulting me about the proposal to cover up the fossil-bearing exposure at Cliffwood Beach is certainly appreciated.

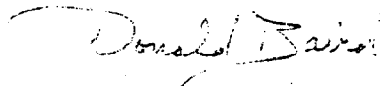
The proposal does not impinge significantly upon my personal field of research (Mesozoic vertebrate paleontology), as Cliffwood Beach is not known for its vertebrate fossils (aside from a few shark teeth). However, as a source of marine invertebrates and remarkably-preserved conifer cones it has long been known as one of the classic fossil sites of New Jersey, one of the "must" stops on any tour of the Cretaceous outcrops of this state. Many a bus load of visiting geologists or college students has disembarked there to study the outcrop of the Magothy Formation and collect specimens. A dozen years ago the site achieved unique fame as the source of two insects, preserved in amber, that proved to be the oldest known ants. These specimens, which have been given the name Sphecomyrma freyi ("Frey's wasp-ant") after their discoverer, belong to a new subfamily of the ant family Formicidae and are of great significance in the history of insects. (Other insects from the same site, related to the present-day mosquitos and midges, still await description.)

For these reasons geologists and paleontologists feel they have a vested interest in maintaining access to the locality, both as a source of future finds and as a place for instructing students. I doubt that there has been a dissenting voice among those you've consulted.

As regards your second question, I have no practical suggestions for inhibiting the slumping of the cliff face -- if indeed that can be done on anything but a short-term basis. It seems to me that the North Atlantic has always proved more than a match for the best engineering technology, and that its tides are not to be checked by man...as King Canute Swenson pointed out a thousand years ago. Anyone who builds near the brink of a sea-cliff composed of unconsolidated sediments should expect the inevitable, and be prepared to shift his house inland.

Your third question is one to which we cannot properly respond without specific knowledge of what would be required. In general terms it appears to me that the maintenance of the Cliffwood Beach exposure for scientific and educational purposes might best be managed by a consortium of concerned institutions, preferably under the leadership of the State University; but we have not yet been approached with such a proposition.

Yours sincerely,



Donald Baird, Director
Museum of Natural History

DB:ipse

57 Oceanport Ave.
W. Long Branch, N.J.

57754

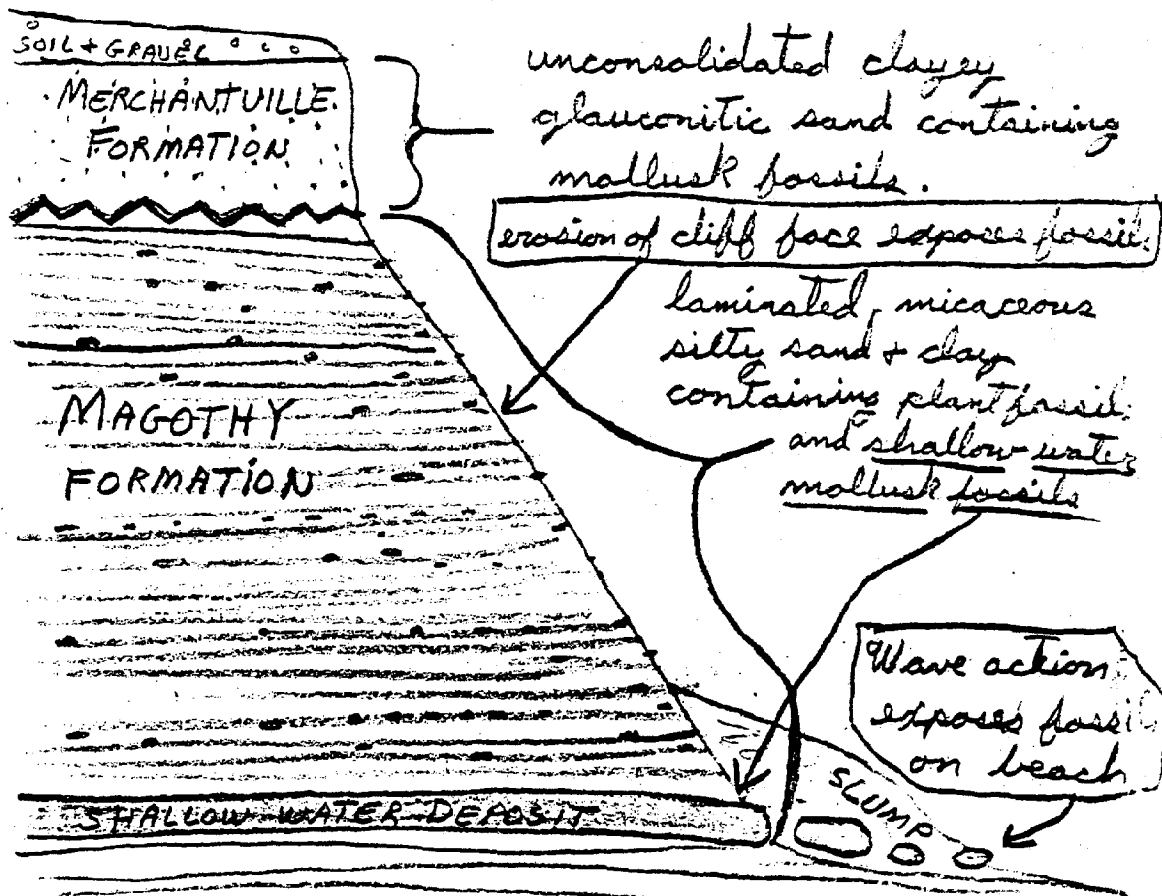
12/29/80

Dear Mr. Kinsey

Please forgive me for not answering your letter sooner. I have had very little spare time lately.

The outcrop at Cliffwood is a unique geological and paleontological site with considerable scientific and educational value. Historically the site is one of the oldest continuously collected fossil localities in the continental U.S. Several classic workers in U.S. paleontology did studies and collected fossil specimens at Cliffwood. Among these Robert P. Whitfield (1892) Stuart Weller (1907) and Horace L. Richards (1952) are notable. The Cliffwood locality is highly fossiliferous. Of particular interest are the plant remains (including amber) and shallow-water marine mollusk fossils in the Magahey formation (see drawing on next page) and the deep water marine mollusk fossils in the overlying Merchantville formation. The shallow water deposit containing fossil mollusks is unique and has not been observed

at any other outcrop of the Magothy formation. Also, Cliffwood is one of the few localities where the contact between Merchantville & Magothy formations is well exposed.



In short it is my opinion that the loss of the Cliffwood site would be a severe blow to the study of geology and paleontology of the Atlantic Coastal Plain.

Concerning the established goals of the D. E. P., namely stopping erosion

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of the cliff face and maintaining the site for paleontological research, I believe the two are basically not reconcilable. The natural process of erosion of the cliff face and the action of waves and tide on the slump at the base of the cliff are responsible for exposing new fossils and replenishing the site. Any structure which prevents this process impedes the collecting of fossil specimens. The present bulkhead has already substantially reduced the site's fossil production by preventing waves from washing away the slump at the base of the cliff. The accumulated slump has totally blocked access to the shallow water marine mollusk fossil bed. Filling in behind the bulkhead will destroy what little is left of the site. If D.E.P. and the State decide the site should be preserved for scientific research I believe the following steps would be appropriate.

1. Purchase the private property above the bluff (possibly under the auspices of the American Museum of Natural History) and provide

housing for the affected people elsewhere.

2. Remove the house, fence, large trees and any objects which are endangered by the receding cliff face. At the present pace of erosion, the removal of all structures within 30 ft of the cliff edge should be sufficient for the foreseeable future.
3. Erect a fence along the top of the cliff about 10 ft back from the edge to prevent people and animals from wandering over the cliff.
4. Remove the bulkhead and allow natural erosion to resume. At the present relatively slow pace of erosion it will be many years before other properties are threatened.
5. Remove garbage, chunks of concrete and other manmade debris from the beach.

The above steps may sound rather extreme, however I believe they are the only real alternative to sealing up the outcrop behind the bulkhead. Preventing erosion and maintaining the site for research in my opinion is like having your cake

and eating it too.

My group (Monmouth Amateur Paleontologists Society) is prepared to offer the following toward preserving Cliffwood:

1. Expertise in the geology and paleontology of the Cliffwood site
2. Some members are willing to donate time toward helping to remove trash from the site and maintain it.
3. I will attempt to solicit funds from amateur geology groups in my area. Any amounts secured however will probably not be large.

I hope the above information is of some help and I personally would like to thank you for attempting to preserve the Cliffwood fossil locality. Good luck!

Sincerely Yours,
Ralph Johnson

